

REMARKS:

Claims 1-16 are in the case and presented for consideration.

Independent Claims 1 and 9 have been amended to better define the nature of the "plasma beam discharge configurations." In this regard it is noted that Okamoto (U.S. Patent 6,017,396) in its Fig. 4, teaches two plasma discharges between respective electrode pairs 11 and 12. As seen in Fig. 6 of the reference, the electrodes 11 and 12 are bar-shaped and the plasma 16 generated therebetween is by no means a plasma beam.

Turning now to the Office Action, Claims 1-8 have been rejected as being obvious and unpatentable over Okamoto (U.S. Patent 6,017,396), in view of Karner, et al. (U.S. Patent 5,753,045). Claim 3 is rejected as being obvious from this combination, taken further in view of U.S. Patent 6,015,597 to David.

On page 5, paragraph 5 of the Office Action, Claims 1-8 were also rejected as being obvious and unpatentable over Ikegaya, EP 0 493 609 A1, in view of Karner, et al. and U.S. Patent 5,340,621 to Matsumoto, et al., with Claim 3 being rejected as being obvious from this combination, taken further in view of U.S. Patent 6,015,597 to David on page 7, paragraph 6 of the Action.

By telephone the Examiner has confirmed that these rejections were actually directed against claims 9-16 and Claim 11 respectively.

The amended wording of Claims 1 and 9 has been selected to make it clear that the discharge axes are substantially longer than any diameter of the plasma beam generation surfaces (see e.g. Fig. 3 of the specification) and such plasma axis in Okamoto e.g. according to Fig. 4 of the reference runs from one plasma generation surface at electrode 12 to the other plasma beam generation surface at the electrode 11 and is substantially

shorter than the extent of the electrodes as in Fig. 6 of the reference.

The language of Claims 1 and 9 that reads: "...the plasma discharge configuration having at least two plasma beam discharge configurations (5, 9), each of said plasma beam discharge configurations having a pair of plasma generation areas that are spaced apart from each other and that face each other, thereby defining therebetween a discharge axis (A) that is substantially longer than any diameter of said discharge generation areas, said discharge axes of said at least two plasma beam discharge configurations being parallel to each other..." is believed to clearly define over Okamoto which is directed to a technique which is not relevant to the present invention. It should be considered that the inflow direction through gas pipe 18 as in Fig. 4 of Okamoto is in fact parallel to a plasma discharge axis defined between plasma generation surfaces. Departing from such primary reference as shown in Fig. 4 one would first have to place the electrodes 12 and 11 of both pairs far from each other. Then one would have to replace the electrodes 11, 12 with an arrangement according to the present invention, because once the electrodes 11 and 12 are mutually spaced by more than their maximum extent (see Fig. 6), no plasma at all would be generated. One would then also have to inlet the gas at one end of such a discharge chamber to ensure a gas flow parallel to the discharge axes.

Such a reconstruction of Okamoto to reach the teaching of the present invention is clearly not obvious. Exactly this would be the approach in combining the teaching of Okamoto with that of Karner, however.

Considering the overall teachings of Okamoto and Karner, the Applicants must strongly disagree with the position expressed at the bottom of page 3 of the Office Action, namely that the person of ordinary skill in the art would be motivated to replace the cold

cathode of Okamoto with a hot cathode of Karner to provide an alternate and equivalent plasma discharge configuration, and further that there would also be motivation for replacing the plasma discharge configuration of Okamoto with the plasma discharge configuration of Karner, also to provide an alternate and equivalent plasma discharge configuration.

David also does not supply the missing insight to combining Okamoto and Karner so that it is believed that all of Claims 1-8 are patentable and in condition for allowance.

Turning now to claims 9-16, Ikegaya teaches a process for producing diamond where thermoelectron radiation CVD is used. Accordingly (see column 7, line 46 of the European Patent Application) "a large area plane of thermoelectron radiation materials obtained by giving a tension to linear thermoelectron radiation materials (high melting point wire rods, carbon fibers)" addresses configuration 10 of the reference. Substrate 7 (see Fig. 1 of Ikegaya) is thus heated, by thermoelectron exposure which is generated by configuration 10. Thus, Ikegaya has nothing at all to do with generating plasma beams and, accordingly, Ikegaya is not relevant but is non-analogous art.

Here again, David is not sufficient to bridge the gap between any obvious combination of Ikegaya, Karner, and Matsumoto, and Claim 11.

In considering whether the person of ordinary skill in the art would combine Karner with Matsumoto as suggested by the Examiner, please note that Matsumoto teaches a plasma discharge configuration that produces "a thin plane shaped, sheet like plasma" (Matsumoto at col. 6, lines 9-11). The sheet plasma spreads out in a plane parallel to the substrate (Matsumoto at col. 6, lines 9-11), and covers practically the entire substrate surface (Matsumoto at Fig. 4). In contrast, the plasma employed in the present invention

is formed about, and extends longitudinally along, at least two substantially parallel beam axes (A), and is clearly defined by the plasma discharge configuration that generates the plasma.

Unlike the sheet plasma of Matsumoto, the width of the plasma beam along the beam axis does not cover the entire substrate surface. It is thus apparent to one of ordinary skill in the art appraised of Matsumoto and the present application, that the plasma discharge configuration recited produces a plasma that has an entirely different geometry than the "sheet like plasma" of Matsumoto.

Karner is concerned with improving homogeneous treatment of large substrate surfaces (Karner at col. 1, lines 62-65). According to Karner, the workpieces undergoing surface treatment are arranged around a cylindrical plasma beam, along a rotational surface (Karner at col. 2, lines 4-8, and Fig. 1). The purpose of this arrangement is to take advantage of the rotational symmetry of the plasma beam discharge (Karner at col. 3, lines 53-61) and to minimize plasma density fluctuations (Karner at col. 3, lines 43-51). Karner does not teach or suggest anything that would lead a person skilled in the art to the conclusion that parallel gas flow with respect to the discharge axis is advantageous over perpendicular gas flow in all PECVD systems.

Due to the orientation of the plasma beam with respect to the substrate retaining surface (Karner at Figs. 1 and 3), the only means of contacting the reactive gas molecules with the substrate surface in this particular system Karner is to have the gas flow from one end of the plasma beam to the other, i.e., parallel to the discharge axis.


Thus, the direction of the gas flow for this type of treatment chamber is strictly a design consideration, and is not generally applicable to all PECVD systems.

Furthermore, the complexity of designing a PECVD system requires consideration of a number of factors other than simply the direction of flow. These factors include, but are not limited to, gas flow velocity, plasma sources; substrate size and composition, gas mixture, reactor geometry, operating conditions and intended application of the system. It is not possible for Karner to have taught or suggested to one of ordinary skill that changing a single criteria related to PECVD systems design (i.e., gas flow configuration with respect to the plasma discharge axis) in other systems with an entirely different plasma geometry and substrate orientation (such as the system described in Matsumoto) will increase the dwell time of the gas in the plasma, and more uniformly coat the deposition configuration.

Accordingly, there is no motivation for those skilled in the art to combine Ikegaya, Karner and Matsumoto to reach Claims 9-16 (or Claims 1-8 for that matter) in an obvious matter as contemplated by 35 U.S.C. 103 so that the application and claims are believed to be in condition for allowance and favorable action is respectfully requested.

The undersigned plans on calling the Examiner to conduct a telephone interview for the purpose of expediting the prosecution of this application. If the Examiner has an opportunity to call the undersigned first, however, such a call would be sincerely welcome.

Respectfully submitted,



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